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Nutritional Potential of Two Lactogenic Plants after Cooking in the Prevention of Hypogalactia: the Case of *Euphorbia hirta L.* and *Secamone afzelii (Shult) K. Shum*.

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Abstract— *To combat hypogalactia, breastfeeding women in rural areas use certain plants in their cooking to induce lactation. However, the nutritional properties of these local products after cooking are not well known. Thus, the aim of this study is to evaluate the nutritional potential of the leafy stems of two plants such as Euphorbia hirta and Secamone afzelii used in Côte d'Ivoire after cooking. The results obtained indicate the presence of proteins (7.55±0.02% ; 8.486±0.04%), total sugars (16.77±0.13 ; 17.93±0.09), reducing sugars (0.619±0.02% ; 0.872±0.03%) and mineral elements such as calcium (1.12±0.08% ; 1.20±0.10%), iron (0.20±0.03%; 0.32±0.02%) and magnesium (0.15±0.01%; 0.54±0.04%) in aqueous extracts from Euphorbia hirta and Secamone afzelii plants after cooking. These results could justify the culinary use of these food plants, which are potential sources of essential nutrients for improving the quality and quantity of breast milk for young children, through the treatment of breastfeeding disorders in women in general. Both plants deserve be valorized. However, further studies on the toxicity of the Secamone afzelii plant are needed.*

Keywords— ***Euphorbia hirta, Secamone afzelii, nutritional potential, nutrients*.**

I. INTRODUCTION

Since prehistoric times, man has always found natural ways to treat himself. The pathologies for which natural means are sought include public health diseases such as malaria, anemia, hypogalactia and malnutrition in nursing mothers. Among these methods, the use of plants plays a major role. In Africa, a great deal of research has been carried out on galactogenic plants, proving their importance for rural populations in particular. The results of work by **Bourobou-Bourobou *et al* (1996)** in Gabon, **Betti and Van Esche (1998)** and **Betti (2002)** in Cameroon, for example, demonstrate the importance of galactogenic plants for populations in rural and urban areas, where breast-feeding should be the main mode of infant nutrition. In rural areas of most developing countries, malnutrition remains one of the major nutritional problems for infants **(Jelliffe, 1989)**, due to the inadequacy of breast milk. In rural areas, indigenous populations often use treatments based on plant extracts to stimulate or induce milk secretion in some women who are unable to breastfeed their offspring after childbirth. The reasons given for this inability to breastfeed seem to be essentially linked to a partial or total absence of milk production in all failing mothers. And yet, as we all know, breast milk plays a vital role not only in the physiology (nutrition and growth) of newborn babies, but also in protecting them against certain illnesses such as diarrhoea

and other deficiencies that can affect them during the first months of life. The lack of this noble foodstuff among breastfeeding women is therefore a very serious threat to the health of infants. One of the main causes of insufficient milk production is severe maternal malnutrition **(Butte and Stuebe, 2020)**. In a bid to provide answers to this unfortunate situation, several authors have carried out scientific studies on African plants reputed to stimulate lactation **(Sawadogo, 1987)**. These have demonstrated that extracts of some of these plants, when administered orally, are indeed capable of inducing milk synthesis in test animals **(Sawadogo, 1987)**.

In Côte d'Ivoire's southern zone, ethnobotanical surveys of lactogenic plants have been carried out. As well as in Benin, a country in the sub-region **(Salifou *et al.*, 2017).**

The survey study in the aforementioned country enabled an inventory to be made of the plants used by rural populations to provide solutions to the breastfeeding problems of Beninese infants but no similar work has been carried out on the knowledge of lactogenic plants used in the joint fight in southern Côte d'Ivoire.

According to research findings, extracts of the plants *Euphorbia hirta* L and *Secamone afzelii* administered orally have been reputed to produce breast milk from traditional recipes, hence the need to conduct a nutritional analysis of *Euphorbia hirta* L and *Secamone afzelii* plants to help assess their nutritional value, the impact of which could influence the quality and quantity of milk produced in women's udders during lactation.

The aim of this work is to carry out a quantitative analysis of the macronutrients (proteins, total sugars and reducing sugars) and micronutrients (calcium, iron and magnesium) in the extracts obtained from the two wild plants, with a view to assessing their nutritional potential in combating breastfeeding disorders in nursing mothers.

II. MATERIAL AND METHODS

MATERIAL

Plant material

The plant material, identified at the Floristic National Centre of Félix Houphouët-Boigny Université of Abidjan, consisted of the plants *Euphorbia hirta* L. (Euphorbiaceae) with number P 00575846 according to the Paris national herbarium and *Sécamone afzelii* (Schult) K. Schum (Asclepiadaceae) with specimen number 120801 (Gabon herbarium).

METHODS

Site selection and data collection

Two localities were chosen; Akoupé on the one hand, because it's in the interior of Côte d'Ivoire. On the other hand, Abidjan, the economic capital and major metropolis, is a cosmopolitan city where many cultures meet. The preliminary surveys carried out enabled us to list the recipes indicated by the female population of these localities with regard to breastfeeding problems. This choice made it possible to study the recipes of these populations in their cultural diversity with regard to breastfeeding problems. Thus, the choice of the two towns enabled us to assess the place occupied by recipes in the dietary habits of the populations of the chosen localities.

Data collection was carried out in southern Côte d'Ivoire. These data are: locality, plant species, harvest, lactogenic plants, endogenous recipes for stimulating lactation for milk production, plants used for recipes, whole plant part, and harvest period.

A sample of 100 women was surveyed, 50 from the town of Akoupé and 50 from the town of Abidjan, during the short dry season from August to September, after the long rainy season from April to July **(SODEXAM/DMN,2008)**.

The plants were harvested during this period for two reasons: firstly, the period indicated will enable us to obtain an undoubtedly high nutrient content, and secondly, easy access to the plants after the renewal cycle in the main rainy season. The people surveyed (n = 100) are in the 25-55 age bracket, the age of the working population.

Sampling

The plant species studied were harvested in the two localities mentioned above (Abidjan and Akoupé). During each month of the short dry season, 3 batches of plants were harvested. Each harvested batch was split into 3 samples of identical mass. A single sample was selected for experimentation. A sample dried in a dry place was placed in a MEMMERT 845 type B 40 oven at 60°C, for quantitative mineral analysis and partially purified extraction for nutrient quality analysis. With two plants, two months and two locations selected, the number of samples is 24.

Preparation of plant extracts for analysis.

Selected plants were harvested, dried and stored in a dry place until use. Extracts were prepared according to the protocol described by **Sawadogo *et al* in 1988**.

Whole plants were ground using a ball mill. One hundred (100) g of the powder obtained was placed in water (5 mL per gram of plant powder). The mixture was boiled for 15 minutes. The mixture was centrifuged at 3000 rpm for 15 minutes.

Once the pellet had been removed, partial purification was carried out using the resulting supernatant. The crude

extract obtained after centrifugation was stirred in the presence of the same volume of chloroform for 5 minutes. The mixture was centrifuged under the same conditions as before, and the supernatant aqueous phase obtained was taken up in 2 volumes of ethanol, followed by the addition of Nacl (0.1). The mixture was stirred and centrifuged again. The resulting pellet was recovered and redissolved in a small volume of water, then freeze-dried to form the partially purified extract for nutritional analysis.

The nutrient analysis of said extract concerns nutrients such as proteins and sugars, with the exception of lipids, as the search for the nutrients mentioned should constitute the nutritional contribution listed as a cofactor **(Houdebine *et al.*, 1990)** to reinforce milk stimulation does not contain lipids. What's more, when a plant product is to be subjected to a partially purified extraction, it is de-oiled beforehand, since fat reduces polysaccharide-water solubility during extraction **(Boni *et al.*, 1990)**. The presence of lipids increases the molecular weight of polysaccharides and blocks the binding of water molecules, preventing swelling of polysaccharide grains and diffusion of polysaccharides out of them.

Determination of protein content

Protein determination **(B.I.P.E.A, 1976)** was carried out using the kjeldhal method and according to the standard **(A.O.A.C, 1975)** using a TECATOR DIGESTOR /Spain mineralizer and a FOSS TECATOR KJELTEC SYSTEM 1002 /Sweden distiller.

Determination of soluble sugar content

Determination of soluble sugar content was carried out using the phenol-sulfuric method, with extraction, defecation and sugar assay stages. Determination was carried out using the **Dubois *et al*. method (1956)**.

Determination of mineral content

Dry mineralization of plants

The mineralization process used is that described by **Biégo *et al.* (2004)**. The dosing method used is Spectr AA-5 flame atomic absorption spectrophotometry of the Varian type, based on the principle that the solution to be analyzed is drawn through a capillary into the nebulizer.

Statistical analysis

The experiments carried out enabled us to collect quantitative data. These data concern proteins, sugars and minerals. An analysis of variance with two classification criteria was used to compare the mean macronutrient and mineral contents of two plants from two harvesting sites. A NEWMAN KEULS test at the 5% threshold was performed to assess the significant difference between the means of macronutrient content in aqueous extracts and mineral content in dried plants, using Statisticat version 7.1 software. For all tables, the means ± standard deviation assigned to various alphabetical letters are significantly different according to the NEWMAN- KEULS test at p less than 5%. Values are means ± standard deviation of 12 trials.

III. RESULTS AND DISCUSSION

Table 1: Yields of partially purified extracts from the Abidjan and Akoupé sites, by plant species.

LOCALITIES	**ABIDJAN**		**AKOUPE**	
Dry plant / Fraction	***Euphorbia hirta***	***Secamone afzelii***	***Euphorbia hirta***	***Secamone afzelii***
Partially purified fraction (%)	1.81±0.09**a**	1.41±0.10**a**	1.79±0.08**a**	1.71±0.07**a**

Table 2: Content of biochemical parameters in extracts

LOCALITIES	**ABIDJAN**		**AKOUPE**	
Extracts / Nutrients	***Euphorbia hirta***	***Secamone afzelii***	***Euphorbia hirta***	***Secamone afzelii***
Total sugars	17.33±0.10**a**	17.93±0.09**a**	17.43±0.12**a**	16.77±0.13**a**
Reducing sugars	0.872±0.03**a**	0.861±0.01**a**	0.619±0.02**a**	0.623±0.04**a**
Proteins	7.74±0.06**a**	8.27±0.07**a**	7.55±0.02**a**	8.486±0.04**a**

Table 3: Mineral composition (mg/l) of plant species harvested at various sites

LOCALITIES	ABIDJAN		AKOUPE	
Plants / Minerals	***Euphorbia hirta***	***Secamone afzelii***	***Euphorbia hirta***	***Secamone afzelii***
Calcium	1.20±0.10**b**	1.12±0.08**b**	1.19±0.07**b**	1.15±0.08**b**
Iron	0.24±0.01**a**	0.20±0.03**a**	0.32±0.02**a**	0.26±0.05**a**
Magnesium	0.35±0.02**a**	0.15±0.01**a**	0.27±0.03**a**	0.54±0.04**a**

According to the recipes, the organs used in Abidjan and Akoupé localities are, on the whole, leafy stems, the decoction of which is said to promote the rise of breast milk in the udder **(Adepo, 2013)**. The decoction preparation method is identical for the *Euphorbia hirta* and *Secamone afzelii* plants. Yields of extracts collected were generally similar, irrespective of harvesting site and plant type (Table 1).

The contents of reducing sugars, total sugars and proteins were equal from one plant to another, whatever the collection site (Table 2). The levels of reducing sugars, total sugars and proteins reported for the *Euphorbia hirta* plant are in line with the results of the qualitative test by **Lanheurs, (2005)**.

The presence of reducing sugars in the *Secamone afzelii* plant is confirmed by the results of the author's qualitative test **Kemeuzé, (2010)**. Also, the experimental protein, iron and magnesium contents of the *Secamone afzelii* plant are lower than those of **Rita *et al*, (2014)** (*Secamone afzelii*; Iron 0.01%, magnesium 12.03%, protein 3.94%). The mean contents of minerals such as calcium, magnesium and iron in plants harvested in the Abidjan and Akoupé regions also show no significant differences (Table 3). This concordance of results could be explained by the proximity of the harvesting areas of the plants listed, as the two regions cited are geographically in the same locality in southern Côte d'Ivoire.

The high levels of calcium in both *Euphorbia hirta* (1.20%) and *Secamone afzelii* (1.15%) compared to magnesium and iron would be justified by the potential use of calcium for plant growth. In addition, the availability of mineral elements according to soil type could justify the variability of mineral contents in the plants studied.

Experimental mineral analysis shows conformity with the qualitative test results of **Lanheurs, 2005**. However, the experimental results for minerals in *Euphorbia hirta* (calcium 1.79%, iron 0.4% and magnesium 0.485%) are generally lower than those of **Tonganga 2014** (calcium 1.04%, magnesium 2.18% and iron 4.19%). This difference in results may be explained by the fact that leaves are the appropriate site for several metabolic reactions in the synthesis of organic compounds involving the use of a high concentration of minerals. Unlike the mineral content of *Euphorbia hirta* plants, for which data are available, there are virtually no studies on the mineral content of the *Secamone afzelii* plant studied.

In general, minerals are said to be the basis for stimulating the action of enzymes involved in the phenomenon of lactation secretion, as minerals constitute the enzymes' metal cofactors. Moreover, according to the experimental study by author **Ndiaye 2018**, calcium phosphate was used.

The *Euphorbia hirta* plant is used as a dietary supplement and lactogen **(Lanhers *et al*., 2005)**. According to the author **Tonganga 2014**, the *Euphorbia hirta* plant would be considered a wild plant but also a food plant due to its moderate levels of anti-nutritional factors such as cyanide, which is found in moderate quantities, nitrate, recorded in trace form, and the absence of oxalate. In addition, the *Secamone afzelii* plant is also considered a food supplement **(Vidal, 2003; Rita *et al*., 2014)**.

A study of the ways in which different plants are used by different populations reveals that these plants could also be used as alicaments. Indeed, many recipes involve incorporating the plant parts studied into everyday dishes.

In view of all the above, the search for minerals in the plants analysed has enabled us to verify that their use could be justified for the treatment of breastfeeding disorders, as they can undoubtedly constitute an important mineral and nutritional source for the lactation stimulation essential for breastfeeding women.

IV. CONLUSION

The results obtained indicate the simultaneous presence of minerals such as calcium, iron and magnesium and nutrients such as reducing and total sugars in the two plants studied. The existence of nutrients that can act in concert with the active ingredient to improve milk production is also noteworthy. Oral administration of the recipes involving the plants mentioned would contribute to the synthesis of breast milk in general, and of antibodies

specifically, by providing some of the macronutrients and micronutrients needed for milk secretion. In fact, these two plants containing proteins, total sugars, reducing sugars and mineral elements such as iron, calcium and magnesium could improve the quantity and quality of breast milk for the infant with the nutritional contribution relative to the nutritional value in plants. As a result, the health of the child and the nursing mother could be significantly improved.

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